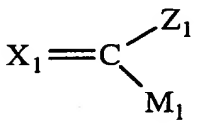
Claims

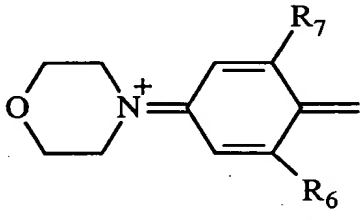
What is claimed is:

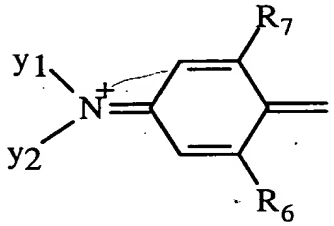
1. A photoinitiator having the following formula:

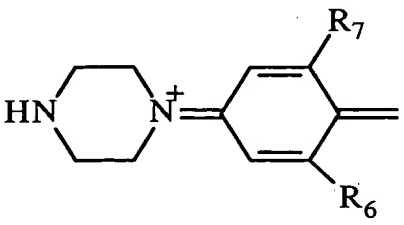


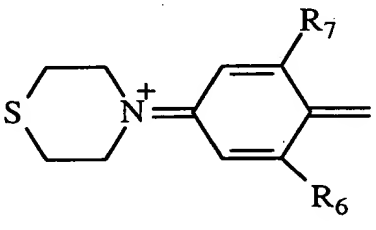
wherein X_1 comprises a conjugated system of one or more aryl groups or substituted aryl groups; Z_1 comprises –O, –S, an alkyl group having from one to six carbon atoms, an ester moiety, a ketone moiety, an amine moiety, an imine moiety, an ether moiety, an aryl or substituted aryl group, a metal or non-metal, or a metal or non-metal containing group; and M_1 comprises an alkyl group, a substituted alkyl group, or forms a five-member ring with Z_1.

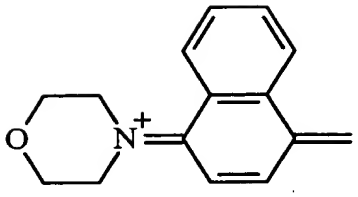
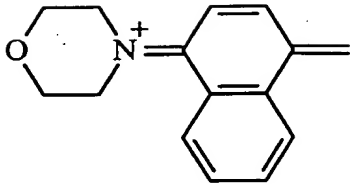
2. The photoinitiator of Claim 1, wherein X_1 comprises



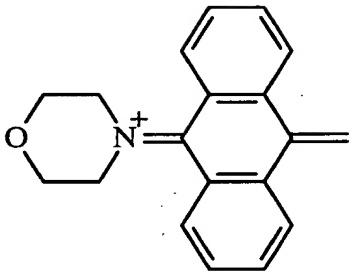




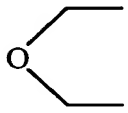


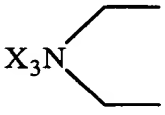
or



wherein R_6 and R_7 each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group; and wherein y_1 and y_2 each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, an aryl group,



or



wherein X_3 represents a hydrogen, an alkyl or substituted alkyl group, or an aryl or substituted aryl group.

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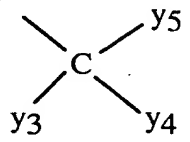
3 ~~4~~. The photoinitiator of Claim 1, wherein M_1 comprises a tertiary alkyl group having the following formula:



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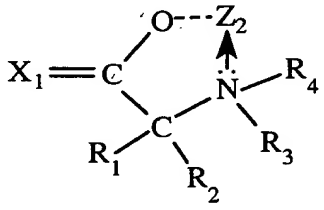
wherein y_3 , y_4 and y_5 each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, a tertiary amine group, an aryl group, or a substituted aryl group.

~~4~~ 5. The photoinitiator of Claim 1, wherein M_1 and Z_1 form a five-member ring.

~~5~~ 6. The photoinitiator of Claim 4 5, wherein the photoinitiator has the following structure:



wherein Z_2 is a metal or non-metal atom, a metal or non-metal containing salt, or –C(O)R, which forms a covalent bond with the oxygen atom; R, R_3 and R_4 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; and R_1 and R_2 are each independently a hydrogen atom, an alkyl or

substituted alkyl group, or an aryl or substituted aryl group, or form one or more aromatic rings with X_1.

6-7. The photoinitiator of Claim 5, wherein R_1, R_2, and X_1 form a photoinitiator having the structure below:

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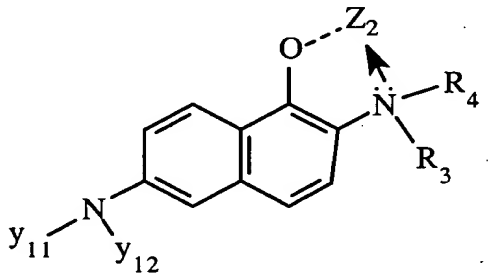

wherein y_{11} and y_{12} are each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, an aryl group,

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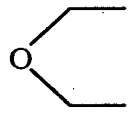
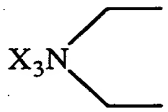


or



wherein X_3 represents a hydrogen, an alkyl or substituted alkyl group, or an aryl or substituted aryl group.

7-8. The photoinitiator of Claim 5-6, wherein the photoinitiator comprises

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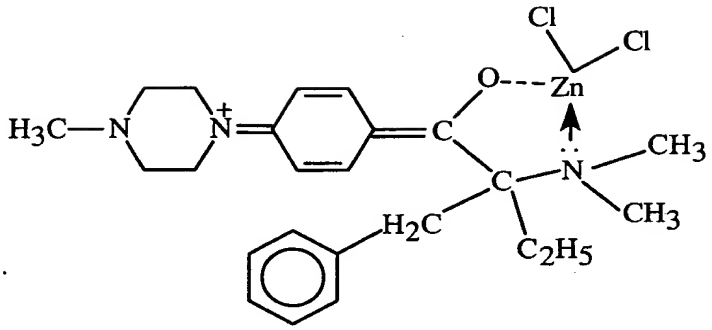
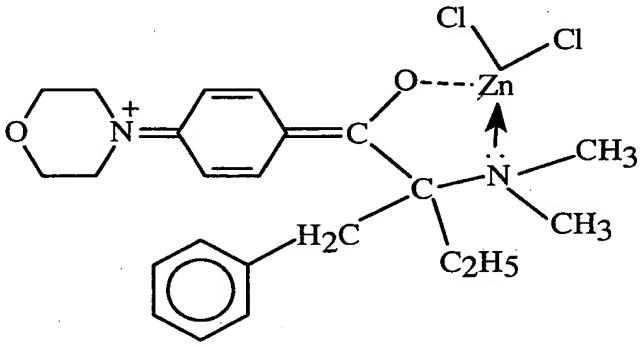
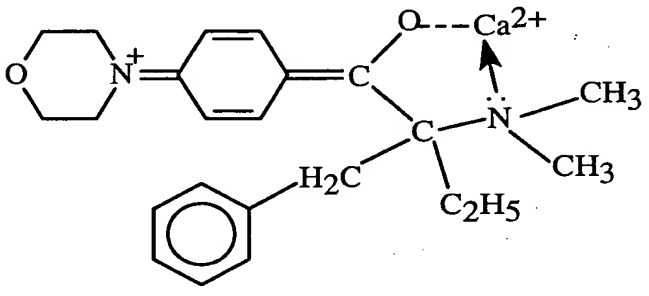


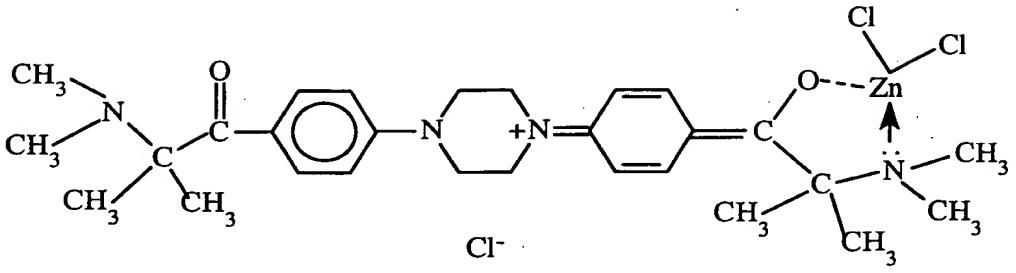
or



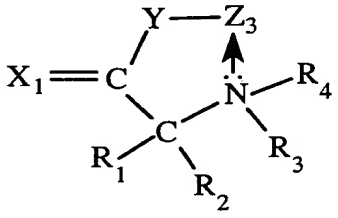
or



or

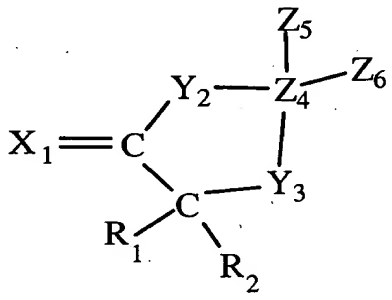


69. The photoinitiator of Claim 4, wherein the photoinitiator has the following structure:



wherein Y is –O– or –N(R_5)–; Z_3 is a metal or nonmetal cation or a salt containing the cation; R_3 and R_4 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; and R_1 and R_2 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group, or form one or more aromatic rings with X_1.

9 10. The photoinitiator of Claim 4 5, wherein the photoinitiator has the following structure:

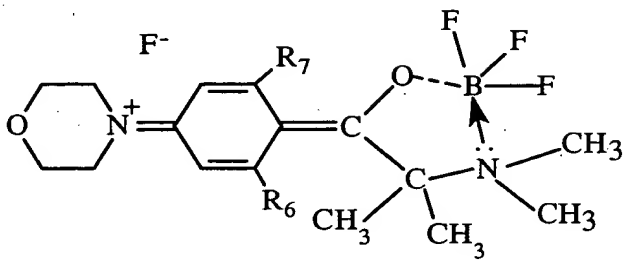


wherein Y_2 and Y_3 each independently represent –O– or –N(R_3)(R_4)–; R_3, and R_4 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; R_1 and R_2 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group or form one or more aromatic rings with X_1; Z_4 is a metal or nonmetal atom; and Z_5 and Z_6 are halogen-containing anions or form one or more rings with or without R_3 or R_4.

10 11. The photoinitiator of Claim 9 10, wherein Z_4 comprises Cd, Hg, Zn, Mg, Al, Ga, In, Tl, Sc, Ge, Pb, Si, Ti, Sn, Zr, boron or phosphorus.

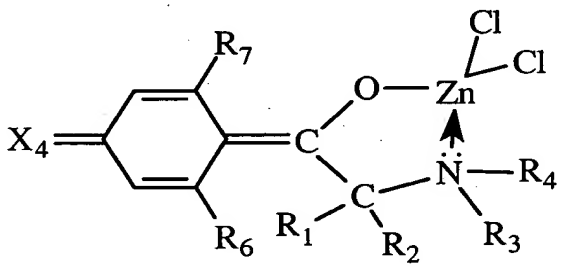
11 12. The photoinitiator of Claim 9 10, wherein Z_5 and Z_6 each independently comprise fluorine, chlorine or bromine-containing anions.

13. The photoinitiator of Claim 9, wherein the photoinitiator comprises



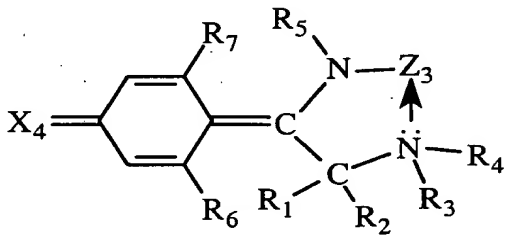
wherein R_6 and R_7 each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

14. The photoinitiator of Claim 9, wherein the photoinitiator has the following structure:



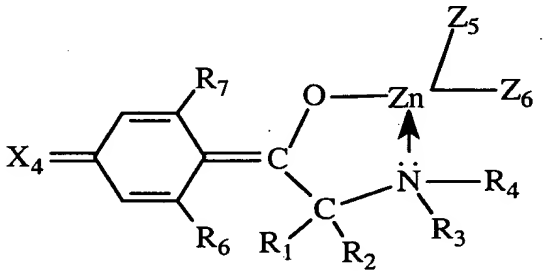
wherein X_4 comprises any nitrogen-containing group, which donates a pair of electrons to the nitrogen-carbon double bond; and R_6 and R_7 each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

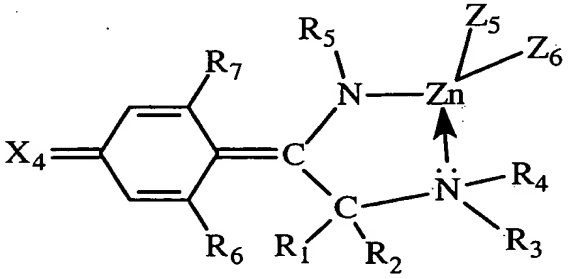
14 ~~15.~~ The photoinitiator of Claim ~~8~~, wherein the photoinitiator has the following structure:

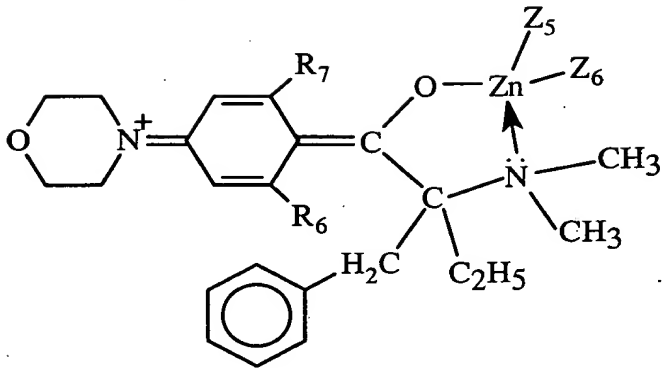


wherein X_4 comprises any nitrogen-containing group, which donates a pair of electrons to the nitrogen-carbon double bond; and R_6 and R_7 each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

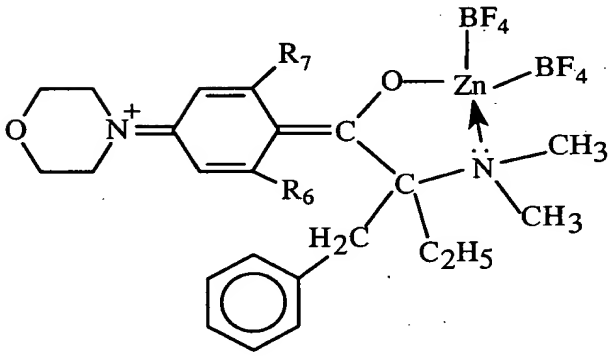
15 ~~16.~~ The photoinitiator of Claim ~~10~~ 9, wherein the photoinitiator has the following structure:







or



16 ~~17~~. A method of generating a reactive species, comprising:

irradiating the cationic photoinitiator of Claim 1 with radiation.

17 ~~18~~. A method of polymerizing a polymerizable material, comprising:

irradiating an admixture of a polymerizable material and the photoinitiator of Claim 1.